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Research Article

The relationship between external debt and growth under the structural breaks in Turkey

Türkiye'nin dış borç ile büyüme arasındaki ilişkisinin yapısal kırılmalar altında incelenmesi

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Abstract

This study aims to investigate whether Turkey's external debt (by considering the debt maturity and ownership separately) has a relationship with economic growth and to explain the direction and size of these effects in case of their existence. At the same time, the relationship between consumption and investment, which are sub-items of growth, and external debt are also discussed. The data subject to the analysis in the study consists of gross domestic product and external debt data provided by the Central Bank of the Republic of Turkey Electronic Data Distribution System and covering the 1998Q1 and 2021Q4 periods. In this study, econometric methods, including both conventional and structural breaks, were used. According to the results, both short-term and long-term external debt significantly and positively affect gross domestic product, consumption and investment. In addition to this situation, it is seen that the effect of long-term external debts is more. However, it is also concluded that the effect of long-term external debt is greater. When evaluated separately on a sectoral basis, it is concluded that the significant and positive relationship between public sector external debt and economic growth and its sub-items is valid both in the short and long term. When the effect of external debt on investments is analyzed, it is seen that the effect of long-term external debt is more than short-term debt. The most important point to note here is that short-term private sector debt, which does not affect gross domestic product and consumption, has a significant effect on investment and is about three times the public sector short-term debt.

Keywords: External Debt, Economic Growth, Structural Break

Jel Codes: F34, F43, C22

Öz

Bu çalışmada, Türkiye'nin dış borçlarının, borcun vadesi ve sahipliği bakımından ayrı ayrı ele alınmak suretiyle, hem ekonomik büyüme hem de büyümenin alt kalemleri olan tüketim ve yatırım ile ilişkisinin var olup olmadığınının araştırılması ve varlığı durumunda bu etkilerin yönünün ve büyüklüğünün açıklanması amaçlanmaktadır. Çalışmada analize konu olan veriler, Türkiye Cumhuriyet Merkez Bankası Elektronik Veri Dağıtım Sistemi tarafından sunulan ve 1998Q1 ile 2021Q4 dönemlerini kapsayan, gayrısafi yurtiçi hasıla ve dış borç verilerinden oluşmaktadır. Hem geleneksel hem de yapısal kırılmaları içeren ekonometrik yöntemlerin kullanıldığı çalışmada elde edilen sonuçlara göre, kısa ve uzun vadeli dış borçların her ikisinin de, gayrısafi yurtiçi hasıla, tüketim ve yatırım üzerinde anlamlı ve pozitif bir etkiye sahip olduğu, bu duruma ek olarak uzun vadeli dış borçların etkisinin daha fazla olduğu görülmektedir. Sektörel bazda ayrı ayrı değerlendirildiğinde, kamu kesimi dış borcu ile ekonomik büyüme ve alt kalemleri arasındaki anlamlı ve pozitif ilişkinin hem kısa hem de uzun vadede geçerli olduğu sonucuna ulaşılmıştır. Dış borcun yatırımlara etkisi incelendiğinde, uzun vadeli dış borcun etkisinin kısa vadeli borçlara göre daha fazla olduğu görülmektedir. Burada dikkat edilmesi gereken en önemli nokta, gayri safi yurtiçi hasıla ve tüketim üzerinde etkisi olmayan kısa vadeli özel sektör borcunun, yatırım üzerinde önemli bir etkiye sahip olduğu ve kamu kesimi kısa vadeli borcunun yaklaşık üç katı olduğudur.

Anahtar Kelimeler: Dış Borç, Ekonomik Büyüme, Yapısal Kırılma

Jel Kodları: F34, F43, C22

Introduction

External debt is a finding that has a historical process and development among countries, based on very old periods, carried out according to the conditions determined between the parties, and which has been the subject of ongoing research and discussions in the economic literature. When external debt is analyzed by definition, it is the process of transferring resources to developing or underdeveloped countries by countries with surplus savings or international organizations. Although the borrowing reasons of developing countries or underdeveloped countries, which are mostly borrowing parties, vary periodically, it is known that the biggest borrowing reasons are insufficient savings. The reason for the inadequacy of savings is that the country's income level is at a level that can only meet the basic needs and wishes of the citizens or is even below this level. This situation creates the need to transfer resources from foreign countries or organizations for countries to finance ordinary expenditures such as any investment, large-scale project initiative and defence expenditures, or extraordinary processes such as war, natural disaster, or epidemic disease. The ultimate goal of all these large-scale projects, employment-creating investments, reduction of foreign trade deficit and elimination of foreign exchange deficiency, which are implemented or thought to be initiated by developing countries, is the ultimate goal of economic growth.

Keynesian theory, the Harrod-Domar model, the twin deficit model and the intertemporal borrowing model can be shown among the models that argue that external borrowing positively affects economic growth. Models suggesting that external debt hurts economic growth are neo-classical and debt surplus models. On the other hand, the debt growth model focuses on debt sustainability. According to Nissanke and Ferrarini (2001), it is rational to go into international borrowing for economies that have to choose between current and future consumption when the domestic interest rate is higher than the world interest rate. Borrowing at a low-interest rate will increase the level of investment and consumption in the country and positively affect economic income and welfare. In Keynesian growth and development models, external debt is thought to affect economic growth positively. In contrast, in Neoclassical models, the negative effects of external debt on economic growth are mentioned. These negativities are based on possible taxes to finance external debt interest payments. Accordingly, the increase in taxes reduces the current consumption of taxpayers and their savings due to the decrease in disposable income and, thus, the capital stock (Diamond, 1965).

In addition to the theories that borrowing will have a positive or negative effect on economic growth, there are also views that borrowing will not impact aggregate demand and growth. These views are based on the Ricardo-Barro (Ricardian equivalence) hypothesis. According to this hypothesis, the public's budget deficit and the closing of this deficit with borrowing do not impact domestic markets and interest rates. The fact that interest rates do not rise prevents the exclusion of private investments. In this model, a budget deficit resulting from tax cuts is financed by borrowing. In the face of this increase in income caused by the expansionary fiscal policy, individuals do not change their consumption and only increase their savings. In this model, in which individuals are assumed to be rational, individuals know that today's tax reduction means an increase in taxes that will be used for debt and interest payments in the future, and they act accordingly. According to this model, the increase in public debt does not affect production, price and interest (Cadik, J. C. J., 2008).

The phenomenon of economic growth is of great importance in the economics literature to measure, predict and explain the changes that have occurred or have the potential to occur, such as progress, change, and development, in modern economic life, using quantitative methods. As it is known, countries in the category of underdeveloped and especially developing countries, to maintain economic life and realize economic growth, their own savings inadequacy is the main reason. Still, they resort to external debt due to many sub-reasons.

This study aims to empirically analyse the relationship between Turkey's external debt between 1998 and 2021 and its economic growth. The analysis of the study differs from the studies in the related literature covering the relationship between external debt and economic growth in three points. The first difference is that in this study, external debt is subjected to public and private sector distinctions and short-term and long-term distinctions. Its relationship with economic growth is analyzed separately. The second difference is that the analysis of the relationship between external debt and economic growth has not only been carried out on the gross domestic product data but also its effects on the sub-items consumption and investment have been examined separately. Finally, the study aims to contribute to the literature by adding a different dimension to the effect of external debt on economic growth by applying structural break models in addition to traditional econometric methods.

Literature review

When the studies investigating the relationship between external debt and economic growth are examined, the unique situation is that the external debt variable is mostly considered as a whole. However, in practice, the effects of the public or private sector in terms of the ownership of the debt and the short-term or long-term debt in terms of maturity on economic growth may differ. In addition, the impact of external debt on consumption, investment and income, and ultimately on economic growth, may differ, along with the sub-items mentioned earlier. Regarding this situation, Çevik and Cural (2013) differentiated public and private foreign debt in terms of ownership. Still, in their analysis, the effect of external debt on growth was not measured numerically. Instead, only causality results were examined.

When the relevant literature is examined in detail, it is seen that most of the studies examining the relationship between Turkey's foreign debt and economic growth conclude that foreign borrowing has negative effects on economic growth. For example, although the number is less compared to the literature, Umutlu, Alizadeh, and Erkılıç (2011), Çevik and Cural (2013), Korkmaz (2015), Toktaş, Altiner and Bozkurt (2019) and Hotunluoğlu and Yavuzer (2020) have reached results that empirically prove that external debt has positive effects on economic growth. In addition to this situation, it is significant that the relevant literature is based on studies examining the effect of change in external debt on economic growth. In contrast, Gürdal and Yavuz (2015) examined the effect of change in economic growth on external debt and concluded that increases in growth rate increase external debt.

Table 1: Literature on the Relationship Between Turkey's External Debt and Economic Growth

Article	Method	The Relationship Between External Debt and Growth
Karagöl (2002)	Vector Autoregressive Model, Johansen Cointegration	Negative
Bilginoğlu (2008)	Least Square	Negative
Uysal et al. (2009)	Johansen Cointegration, Granger Causality	Negative
Çiçek et al. (2010)	Least Square	Negative
Umutlu et al. (2011)	Johansen Cointegration, Granger Causality	Positive
Çevik ve Cural (2013)	Vector Autoregressive Model, Toda Yamamoto Causality	Positive
Çelik ve Direkci (2013)	Johansen Cointegration, Granger Causality	Negative
Korkmaz (2015)	Johansen Cointegration, Error Correction Model Causality	Positive
Gürdal and Yavuz (2015)	Gregory Hansen Cointegration	Positive
Kutlu ve Yurttagüler (2016)	Johansen Cointegration, Granger Causality	Negative
Ağır (2016)	Johansen Cointegration, Toda Yamamoto Causality, Diks-Panchenko Causality, Hatemi J Asymmetric Causality	Negative
Gögül (2016)	Maki Cointegration	Negative
Tülümce ve Yavuz (2017)	ARDL Cointegration, Error Correction Model	Negative
Doruk (2018)	Bayer-Hanck Cointegration	Negative
Toktaş et al. (2019)	Hacker-Hatemi-J Causality, Hatemi J Asymmetric Causality	Positive
Yıldız (2019)	Johansen Cointegration, Granger Causality	Positive
Benli (2020)	ARDL Cointegration, Error Correction Model	Negative
Hotunluoğlu and Yavuzer (2020)	Engle-Granger Cointegration	Positive
Görgün (2020)	Maki Cointegration	Negative
Biçer (2020)	ARDL Cointegration	Negative
Arslan (2022)	Vector Autoregressive Model, Granger Causality	Negative

Another great point about the literature is that methods that do not take into account the structural breaks that occur in the series, which are called traditional econometric methods, are widely used in the analysis of the studies. As seen in Table 1, only Gürdal and Yavuz (2015), Gögül (2016) and Görgün (2020) used cointegration tests with structural breaks in their analyses. They explained how the external debt growth relationship was shaped when structural breaks were included in the model. In addition to these studies, the only study examining Turkey's external debt using structural break methods is Önel and Utkulu (2006). However, in the study, the relationship between external debt and growth was not analysed, the sustainability of external debt was discussed, and it was concluded that it was unsustainable. In addition, there are studies in the literature that examine the stationarity of the series with structural break unit root tests but use cointegration tests without a structural break (Çevik and Cural (2013), Doruk (2018), Özkul and Öztürk (2021)).

Empirical findings

In this study, the effect of external debt on economic growth is analysed with quarterly data covering the years 1998 and 2021 provided by the Central Bank of the Republic of Turkey's Electronic Data Distribution System. The dependent variables used in the analysis are gross domestic product (GDP) at

constant prices, consumption (CONS) and investment (INV), which are sub-items of gross domestic product, respectively. The independent variables are short-term external debt (SRED), long-term external debt (LRED), short-term public sector external debt (SRG), short-term private sector external debt (SRP), long-term public sector external debt (LRG) and long-term private sector external debt (LRP). In addition, the logarithm of the data of all variables was used.

For a time series to be stationary, its mean and variance should not change over time, and the covariance between two periods should depend only on the distance between the two periods, not the period in which this covariance was calculated (Gujarati, 2005). Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1979) and Phillips and Perron (PP) (Phillips and Perron, 1988) unit root tests which is one of the traditional unit root tests used in this study, analyse without considering possible structural breaks in the series. However, one of the causes of non-stationarity in time series is structural breaks in the series. For this reason, the Lee and Strazicich (2003) test, which makes unit root analysis by considering the presence of structural breaks, was also used in the study. The Dickey-Fuller test is based on the following three regression equations:

None $: \Delta Y_t = \gamma Y_{t-1} + \mu_t$ (1)

Constant $: \Delta Y_t = \alpha_0 + \gamma Y_{t-1} + \mu_t$ (2)

Constant and Trend $: \Delta Y_t = \alpha_0 + \alpha_1 t + \gamma Y_{t-1} + \mu_t$ (3)

If there is autocorrelation in the error term u_t in the above equations, the required number of lags (m) is added to the model as in equation (4) to eliminate this situation.

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \gamma Y_{t-1} + \beta_i \sum_{i=1}^{m} \Delta Y_{t-i} + \mu_t \quad (4)$$

The unit root test applied this way is known as the ADF test. However, since the ADF unit root test does not consider the possibility of structural break, if the series is stationary, the analyses based on these results may be biased (Sevüktekin and Nargeleçekenler, 2010). For this reason, Lee and Strazicich's (2003) unit root test with two breaks, which is an LM (Lagrange Multiplier) based unit root test, was used in the study. According to the results in Table 2, it is seen that the variables are not stationary at the level, but they are stationary at the first difference, that is, I(1).

Table 2: Traditional Unit Root Test Results

Variable	ADF				PP			
	Constant		Constant and Trend		Constant		Constant and Trend	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
GDP	-0.193	-3.258**	-3.243*	-3.240*	-0.660	-18.367***	-7.342***	-18.447***
CONS	0.521	-2.937**	-3.571**	-3.01*	-0.097	-17.000***	-6.571***	-17.576***
INV	-1.277	-2.800*	-2.659	-2.843	-0.820	-16.400***	-4.222***	-16.273***
SRED	-1.196	-6.611***	-1.496	-6.620***	-1.298	-6.681***	-1.480	-6.693***
SRG	-2.158	-8.067***	-3.531*	-8.254***	-2.191	-10.620***	-3.531*	-10.745***
SRP	-1,360	-6.779***	-1.138	-6.826***	-1.489	-6.855***	-1.088	-6.856***
LRED	-2.969*	-7.639***	-0.297	-7.639***	-0.297	-8.166***	-2.526	-7.822***
LRG	-0.772	-9.466***	-2.196	-9.424***	-0.772	-9.463***	-2.196	-9.421***
LRP	-1.232	-3.896***	-0.800	-3.995**	-1.999	-5.505***	-0.661	-5.804***

***,** and * indicate significance at the 1%, 5% and 10% levels, respectively.

The Lee and Strazicich (2003) test differs from other structural break tests at the point of the null hypothesis. Because the critical values produced in ADF-type unit root tests are problematic, for they are based on the null hypothesis that advocates the absence of breakage. For example, Zivot and Andrews (1992) and Lumsdaine and Papell's (1997) unit root tests assume that there is no break in the null hypothesis of the existence of a unit root, and critical values are produced according to this assumption. The alternative hypothesis is the possibility of a unit root with structural breaks in the series. Rejecting the null hypothesis means that the unit root without a structural break is rejected and rejects the unit root. It is the unit root without a structural break that is rejected here. At this point, Lee and Strazicich (2003) argue that the alternative hypothesis used in these tests should not be stationary with a structural break. While the null hypothesis of Lee and Strazicich (2003) states a structural break, the alternative hypothesis expresses trend stationarity. However, the critical values generated for the LM unit root test have an important advantage as they are not affected by structural breaks (Narayan and Smyth 2007). For this reason, it is considered that the LM unit root test is more flexible and more powerful than the ADF-type tests. The test has two different states: Model A, which indicates a break in level, and Model C, which indicates a break in both level and trend.

Model A:

$$\Delta r_t = \alpha y_{t-1} + \mu + \beta_t + \theta DU1_t(\lambda) + \psi DU2_t(\lambda) + \sum_{i=1}^{k} c_i \Delta r_{t-i} + \varepsilon_t \quad (5)$$

Model C:

$$\Delta r_t = \alpha y_{t-1} + \mu + \beta_t + \theta DU1_t(\lambda) + \gamma DT1_t^*(\lambda) + \psi DU2_t(\lambda) + \omega DT2_t^*(\lambda) + \sum_{i=1}^{k} c_i \Delta r_{t-i} + \varepsilon_t \quad (6)$$

Model A investigates the existence of two structural breaks in the series' mean, while Model C investigates the presence of two structural breaks in the mean and trend of the series. In Model A, DU1t and DU2t are dummy variables created to detect the change periods in the mean. In Model C, DT1t and DT2t (provided that TB2>TB1+2) is the dummy variables created to detect the change periods in the trend and can be expressed as follows:

$$DU1_t = \{1 \quad if\ t > TB_1\ ,0 \quad in\ other\ case$$

$$DU2_t = \{1 \quad if\ t > TB_2\ ,0 \quad in\ other\ case$$

$$DT1_t = \{t - TB_1 \quad if\ t > TB_1\ ,0 \quad in\ other\ case$$

$$DT2_t = \{t - TB_2 \quad if\ t > TB_2\ ,0 \quad in\ other\ case$$

In the LM unit root test, if the t statistic of the α parameter is smaller than the critical values determined by Lee and Strazizich (2003), it is decided that the series is stationary with a structural break.

Based on this situation, when the Lee and Strazicich unit root test results with two breaks in Table 3 are examined, it is seen that the basic hypothesis for the level value variables, that is, the existence of a unit root with a structural break, is accepted. However, suppose the first difference of the series is taken. In that case, the hypothesis that all variables contain a unit root with a structural break is rejected, and the variables are assumed to be stationary.

Table 3: Lee ve Strazicich Unit Root Test Results

	Level				First Difference			
	Model A (t-ist)	**Break Date**	**Model C (t-ist)**	**Break Date**	**Model A (t-ist)**	**Break Date**	**Model C (t-ist)**	**Break Date**
GDP	-3.898*	2006Q4 2016Q4	-5.312	2002Q1 2008Q2	-3.216	2016Q2 2019Q2	-9.468***	2001Q3 2007Q4
CONS	-3.808*	2002Q1 2019Q1	-5.311	2002Q1 2018Q1	-4.482	2006Q1 2016Q1	-10.539***	2016Q3 2019Q2
INV	-3.346	2002Q1 2019Q4	-5.338	2003Q3 2018Q1	-5.636*	2001Q1 2010Q2	-8.421***	2002Q3 2007Q4
SRED	-2.161	2008Q1 2015Q3	-4.735	2003Q1 2015Q1	-6.467***	2001Q1 2008Q3	-7.364***	2001Q4 2019Q2
LRG	-2.682	2001Q4 2019Q3	-4.348	2001Q3 2005Q3	-10.260***	2002Q3 2019Q3	-10.280***	2002Q1 2005Q4
SRP	-1.888	2008Q1 2015Q3	-4.696	2003Q2 2015Q2	-6.995***	2001Q1 2009Q2	-7.425***	2001Q1 2009Q2
LRED	-2.567	2010Q4 2014Q4	-5.106	2006Q2 2019Q4	-8.904***	2005Q2 2012Q1	-10.218***	2005Q2 2008Q2
SRG	-2.447	2015Q2 2018Q2	-3.307	2001Q1 2011Q4	-10.458***	2006Q2 2010Q4	-10.937***	2005Q3 2008Q3
LRP	-2.664	2004Q4 2010Q2	-5.708	2005Q3 2011Q3	-3.308	2004Q4 2014Q4	-7.064***	2002Q3 2008Q1

Note: *** p < 0.01, ** p < 0.05, * p < 0.10. The critical values for Model A are, -4.545, -3.842, -3.504, for model C, λ1:0.4 λ2:0.8 -6.42, -5.65, -5.32; λ1:0.4 λ2:0.6 -6.45, -5.67, -5.31; λ1:0.2 λ2:0.8 -6.33, -5.71, -5.33 ; λ1:0.4 λ2:0.6 -6.45, -5.67, -5.31 ; λ1:0.6 λ2:0.8 -6.32, -5.73, -5.32.

If the linear combination of two or more series that are not singularly stationary (but integrated of the same order) are stationary, these series are considered cointegrated (Hendry and Juselius, 2001; Wojcik, 2011). Engel and Granger's (1987) two-stage single equation method and Johansen's (1995) maximum probability approach are two of the most widely used methods to determine the cointegration relationship. This study used Johansen's (1995) cointegration test to define the cointegration relationship. The Johansen cointegration test uses two test statistics. The first is the trace statistic, which tests the null hypothesis that the rank (Π) of the matrix is less than or equal to the number of cointegration vectors (r), and the second is the maximum eigenvalue statistic, which tests the null hypothesis for the existence of cointegration vectors.

While the vector error correction model (VECM) is used when there is a cointegration relationship between the exogenous variables (Johansen, 1988), the vector autoregressive model (VAR) is used for the differentiated series when there is no cointegration relationship (Sims, 1980). Since there is a cointegration relationship between the series in this study, the VECM model was used. The VECM model is a multi-factor system that brings error correction features to the VAR model. The most

important feature of the model is that it allows the definition of a long-term equilibrium relationship that can be used to increase the success of long-term predictions of the series in the system. The long-run equilibrium relationship can be determined from the cointegration vector. The error correction model with degrees of cointegration r (≤n), represented as VECM (p), can be written as follows:

$$\Delta y_t = \delta + \Pi y_{t-1} + \sum_{l=1}^{p-1} \phi_l^* \Delta y_{t-1} + \varepsilon_t \quad (7)$$

In equation (7), r is the number of cointegration vectors, Δ is the difference operator, Π=αβ^', α and β are n x r matrices, ϕ_i^* is n x n matrix. Cointegration vector β is the long-run parameter, and α is the adjustment coefficient. In the case of cointegration with exogenous variables, VECM, VECMX (p,m) with exogenous variables can be written as:

$$\Delta y_t = \delta + \Pi y_{t-1} + \sum_{l=1}^{p-1} \phi_l^* \Delta y_{t-1} \sum_{l=0}^{m} I^* x_{t-l} + \varepsilon_t \quad (8)$$

In the Granger causality concept (Granger, 1988), if yt can be used in future forecasting for xt by definition, then yt becomes the granger cause of xt. The existence of a causal connection between the series is examined under equation (9) features:

$$[\Delta y_t \ \Delta x_t\ ] = [\sigma_1\ \sigma_2\ ] + \sum_{i=1}^{p} [\gamma_{11}\ \gamma_{12}\ \gamma_{21}\ \gamma_{22}\ ][\Delta y_{t-1}\ \Delta x_{t-1}\ ] + [\varepsilon_1\ \varepsilon_2\ ][ECT_{t-1}] + [\mu_{1t}\ \mu_{2t}\ ] \quad (9)$$

In the above equation, Δ is the delay operator, ECT_{t-1} is the delayed error correction term derived from the long-run cointegration relationship. μ_{1t} and μ_{2t} are independent random error terms. The dependent variable is estimated in response to the past values of itself and other variables. The optimum lag length p in this process is based on the maximum probability procedure of Johansen and Juselius (1990). However, the causality test does not allow us to know about the dynamic system properties outside the sampling period.

The results of the Johansen (1988) cointegration test applied after it was determined that all variables used in the study were 1st degree integrated I(1) are presented in Table 4. When the results are examined, at least one and at most 2, there are cointegration equations in both trace and max eigenvalue statistics for all models used in the analysis. This shows that the variables in the models act together in the long run. That is, they are cointegrated.

Table 4: Johansen Cointegration Test Results

		λ	Trace	%10 C.V	Prob.		Max-λ	%10 C.V	Prob.
GDP SRED LRED	None*	0.197	41.186	24.275	0.000	None*	20.040	17.797	0.022
	At most 1*	0.131	21.145	12.320	0.001	At most 1*	12.825	11.224	0.025
GDP SRG SRP	None***	0.244	32.805	24.275	0.003	None***	32.805	24.275	0.003
	At most 1	0.042	7.314	12.320	0.294	At most 1	7.314	12.320	0.294
GDP LRG LRP	Hiç***	0.244	32.805	24.275	0.003	None***	25.491	17.797	0.002
	En çok 1	0.042	7.314	12.320	0.294	At most 1	3.988	11.224	0.630
CONS SRED LRED	None**	0.254	48.394	42.915	0.012	None***	26.680	25.823	0.038
	At most 1	0.137	21.714	25.872	0.151	At most 1	13.416	19.387	0.295
CONS SRG SRP	None***	0.245	33.988	24.275	0.002	None***	25.608	17.797	0.002
	At most 1	0.055	8.379	12.320	0.208	At most 1	5.237	11.224	0.444
CONS LRG LRP	None**	0.228	39.196	35.192	0.017	None**	23.579	22.299	0.033
	At most 1	0.100	15.616	20.261	0.193	At most 1	9.668	15.892	0.365
INV SRED LRED	None***	0.228	31.633	24.275	0.005	None***	24.404	17.797	0.004
	At most 1	0.062	7.229	12.320	0.302	At most 1	6.083	11.224	0.340
INV SRG SRP	None	0.128	17.474	24.275	0.281	None	12.965	17.797	0.230
	At most 1	0.026	4.508	12.320	0.637	At most 1	2.558	11.224	0.852
INV LRG LRP	None***	0.229	38.264	24.275	0.000	None***	24.301	17.797	0.004
	At most 1**	0.125	13.962	12.320	0.026	At most 1**	12.471	11.224	0.030

***, ** and * indicate the presence of cointegration at the level of 1%, 5% and 10%, respectively.

Similar to the situation in unit root tests, cointegration tests that do not consider the possibility of structural break can also produce biased results. For this reason, structural breaks in cointegration tests should be considered. Maki (2012) developed a method that can test the cointegration relationship between the variables in the presence of five structural breaks. In cases where there are three or more structural breaks in the cointegration equation, Maki's (2012) cointegration method is more powerful

than Gregory and Hansen's (1996) and Hatemi-J's (2008) methods. In this method, all variables to be analysed must be I(1) (Göçer and Peker, 2014). Maki (2012) developed four different models for this test:

Model 0: Level Shift;

$$y_t = \mu + \sum_{i=1}^{k} \mu_i K_{i,t} + \beta x_t + \mu_t \quad (10)$$

Model 1: Level Shift with Trend;

$$y_t = \mu + \sum_{i=1}^{k} \mu_i K_{i,t} + \beta x_t + \sum_{i=1}^{k} \beta_i x_i K_{i,t} + \mu_t \quad (11)$$

Model 2: Regime Shift;

$$y_t = \mu + \sum_{i=1}^{k} \mu_i K_{i,t} + \gamma x + \beta x_t + \sum_{i=1}^{k} \beta_i x_i K_{i,t} + \mu_t \quad (12)$$

Model 3: Trend and Regime Shift;

$$y_t = \mu + \sum_{i=1}^{k} \mu_i K_{i,t} + \gamma x + \sum_{i=1}^{k} \gamma_i t K_{i,t} + \beta x_t + \sum_{i=1}^{k} \beta_i x_i K_{i,t} + \mu_t \quad (13)$$

K_i, dummy variables are defined as follows:

$$K_i = \{1 \qquad t > T_B\ , 0 \quad in\ other\ cases \quad \} \quad (14)$$

T_B refers to the date of the structural break. Then, depending on the critical values calculated by Monte Carlo simulation and given in Maki (2012), the existence of a cointegration relationship is decided. According to the Maki (2012) cointegration test results in Table 5, it is seen that the null hypothesis is rejected at least once for each model. That is, there is a cointegration relationship.

Table 5: Maki (2012) Cointegration Test Results

	Models	Test Statistic	Break Dates
GDP SRED LRED	Model 0 (Level Shift)	-4.233	2020Q2 2019Q1 2000Q4 2009Q4 2013Q4
	Model 1 (Level Shift with Trend)	-4.436	2008Q1 2020Q2 2011Q2 2000Q4 2014Q4
	Model 2 (Regime Shift)	-5.535	2014Q4 1998Q1 2019Q1 2016Q3 2001Q3
	Model 3 (Trend and Regime Shift)	-6.252*	2008Q1 2000Q4 2019Q1 2013Q3 2016Q3
GDP SRG SRP	Model 0 (Level Shift)	-5.296	2020Q2 2016Q3 2014Q4 2002Q4 2013Q1
	Model 1 (Level Shift with Trend)	-4.864	2008Q1 2000Q1 2020Q2 2014Q4 2013Q1
	Model 2 (Regime Shift)	-4.968	2020Q2 2014Q3 2001Q4 2012Q3 2018Q3
	Model 3 (Trend and Regime Shift)	-6.114*	2019Q4 2008Q4 2006Q1 2001Q1 2002Q3
GDP LRG LRP	Model 0 (Level Shift)	-5.185	2020Q2 2019Q1 2008Q1 2011Q2 2013Q1
	Model 1 (Level Shift with Trend)	-4.517	2000Q4 2008Q1 2018Q2 2011Q2 2004Q1
	Model 2 (Regime Shift)	-5.131	2010Q1 2020Q2 2019Q1 2014Q2 2017Q1
	Model 3 (Trend and Regime Shift)	-7.492***	2008Q1 2020Q1 2011Q2 2001Q3 2006Q3
CONS SRED LRED	Model 0 (Level Shift)	-4.704	2020Q2 2016Q3 2012Q4 2005Q4 2014Q4
	Model 1 (Level Shift with Trend)	-4.950	2020Q2 2018Q3 2000Q4 2016Q3 2008Q1
	Model 2 (Regime Shift)	-5.344	2019Q1 2010Q1 2001Q3 2016Q3 2008Q1
	Model 3 (Trend and Regime Shift)	-6.270*	2008Q4 2000Q4 2017Q4 2013Q3 2007Q1
CONS SRG SRP	Model 0 (Level Shift)	-5.944**	2020Q2 2016Q3 2002Q2 2014Q2 2010Q4
	Model 1 (Level Shift with Trend)	-4.888	2020Q2 2008Q1 2016Q3 2012Q4 2010Q4
	Model 2 (Regime Shift)	-5.917	2020Q2 2014Q2 2001Q3 2016Q3 2008Q2
	Model 3 (Trend and Regime Shift)	-6.804**	2019Q4 2008Q1 2010Q3 2001Q3 2005Q4
CONS LRG LRP	Model 0 (Level Shift)	-5.099	2020Q2 2016Q3 2010Q1 2014Q2 2005Q4
	Model 1 (Level Shift with Trend)	-4.843	2020Q2 2010Q4 2008Q1 2018Q3 2001Q1
	Model 2 (Regime Shift)	-4.950	2010Q2 2020Q2 2019Q1 2002Q4 2005Q3
	Model 3 (Trend and Regime Shift)	-6.369*	2020Q1 2001Q2 2014Q2 2008Q1 2011Q1
INV SRED LRED	Model 0 (Level Shift)	-4.719	2020Q2 2008Q1 2013Q4 2004Q4 2000Q4
	Model 1 (Level Shift with Trend)	-4.450	2008Q1 2000Q4 2006Q3 2002Q2 1993Q3
	Model 2 (Regime Shift)	-6.174*	2008Q1 2001Q4 2018Q3 1999Q3 2005Q2
	Model 3 (Trend and Regime Shift)	-5.571*	2008Q1 2001Q4 2003Q3 2001Q3 2018Q1
INV SRG SRP	Model 0 (Level Shift)	-4.264	2020Q2 2011Q1 2001Q4 2008Q1 2006Q4
	Model 1 (Level Shift with Trend)	-4.331	2008Q1 2015Q3 2009Q4 1999Q3 2001Q4
	Model 2 (Regime Shift)	-4.876	2020Q2 2003Q3 2018Q4 2002Q3 2014Q2
	Model 3 (Trend and Regime Shift)	-6.872**	2020Q2 2000Q4 2007Q4 2006Q4 2014Q1
INV LRG LRP	Model 0 (Level Shift)	-4.889	2008Q1 2013Q4 2018Q2 2002Q1 2016Q1
	Model 1 (Level Shift with Trend)	-4.618	2010Q2 2001Q4 2020Q2 2015Q3 2013Q4
	Model 2 (Regime Shift)	-5.691	2008Q1 2020Q2 2011Q2 2002Q3 2004Q2
	Model 3 (Trend and Regime Shift)	-7.337***	2008Q1 2020Q2 1999Q3 2011Q2 2001Q4

* Critical Values (%1-%5-%10) Level Shift: -6.296 -5.760 -5.491, Level Shift with Trend: -6.530 -5.993 -5.722, Regime Shift: -6.784 -6.250 -5.976, Trend and Regime Shift: -7.053 -6.494 -5.220.

As Granger (1988) stated, if there is any cointegration relationship between the variables analysed in the study handled, it is considered that there is at least a one-way causality relationship between these variables. Because of this situation, it will be more likely to give more reliable, healthy and clear results

by using the error correction model (VECM) instead of using the standard VAR analysis to determine the causality relationships in question (Çetinkaya, 2014).

When the causality analysis results in Table 6 are examined, it is seen that there is a causal relationship with both the gross domestic product, consumption and investment when external debts are divided into short-term and long-term. In addition, it is seen that the direction of causality is from short-term and long-term external debt to gross domestic product, consumption and investment. When the short-term distinction between public and private debts is in question, it is seen that there is a causal relationship with both gross domestic product, consumption and investment. On the other hand, the direction of causality is seen to be from short and long-term external debt to gross domestic product, consumption and investment. Regarding the distinction between public and private long-term external debt, there is only causality with the gross domestic product. Still, there is no valid causality relationship between investment and consumption. When viewed individually, it is seen that there is a causal relationship between both short-term and long-term private sector debt and gross domestic product. However, consumption, investment, and only short-term private sector external debt are in a causal relationship.

Table 6: VECM Causality Test Results

	GDP SRED LRED		
Δ (**GDP**)	Δ (**SRED**) 12.818 (0.012)**	Δ (**LRED**) 3.630 (0.458)	Δ (**SRED**) / Δ (**LRED**) 17.871 (0.022)**
	GDP SRG SRP		
	Δ (**SRG**) 4.941 (0.293)	Δ (**SRP**) 16.004 (0.003)***	Δ (**SRG**) / Δ (**SRP**) 17.795 (0.022)**
	GDP LRG LRP		
	Δ (**LRG**) 11.584 (0.020)**	Δ (**LRP**) 28.422 (0.000)***	Δ (**LRG**) / Δ (**LRP**) 45.579 (0.000)***
	CONS SRED LRED		
Δ (**CONS**)	Δ (**SRED**) 15.451 (0.003)***	Δ (**LRED**) 2.805 (0.591)	Δ (**SRED**) / Δ (**LRED**) 17.254(0.027)**
	CONS SRG SRP		
	Δ (**SRG**) 2.408 (0.661)	Δ (**SRP**) 14.971 (0.004)***	Δ (**LRG**) / Δ (**SRP**) 15.864 (0.044)**
	CONS LRG LRP		
	Δ (**LRG**) 1.99 (0.736)	Δ (**LRP**) 4.756 (0.313)	Δ (**LRG**) / Δ (**LRP**) 7.616(0.471)
	INV SRED LRED		
Δ (**INV**)	Δ (**SRED**) 9.313 (0.002)**	Δ (**LRED**) 0.0162 (0.898)	Δ (**SRED**) / Δ (**LRED**) 9.347 (0.009)**
	INV LRG SRP		
	Δ (**SRG**) 0.073 (0.786)	Δ (**SRP**) 6.443 (0.011)**	Δ (**SRG**) / Δ (**SRP**) 6.544 (0.037)**
	INV LRG LRP		
	Δ (**LRG**) 1.856 (0.395)	Δ (**LRP**) 0.201 (0.904)	Δ (**LRG**) / Δ (**LRP**) 2.120 (0.713)

***,** and * denote causality at the 1%, 5% and 10% levels, respectively.

The fully modified least squares (FMOLS) estimator was developed by Phillips and Hansen (1990) to eliminate the problems caused by the long-run correlation between the cointegration equation and stochastic shocks. The FMOLS estimator, which gives good results even in small samples, is asymptotically unbiased and consistent. The FMOLS equation is expressed as:

$$Y_t = X_t'\beta + D_{1t}'\gamma_1 + \mu_{1t} \quad (15)$$

In Equation (15), $D_t = (D_{1t}', D_{2t}')$ denotes deterministic trend variables. Stochastic variables are obtained from equation (16) with their level values or from equation (17) as their immediate difference.

$$X_t = \Gamma_{21}, D_{1t} + \Gamma_{22}, D_{2t} + \varepsilon_{2t} \quad (16)$$

$$\Delta X_t = \Gamma_{21}, \Delta D_{1t} + \Gamma_{22}, \Delta D_{2t} + \mu_{2t} \quad (17)$$

It is expressed $\mu_{2t} = \Delta\varepsilon_{2t}$ as corrected data,

$$y_t^+ = y_t - \omega_{12}\Omega_{22}^{-1}\mu_{2t} \quad (18)$$

The bias correction term is obtained as follows.

$$\lambda_{12}^+ = \lambda_{12} - \omega_{12}\Omega_{22}^{-1}\Lambda_{22} \quad (19)$$

(Ω and Λ) represent long-term covariance matrices calculated with residues $\mu_t = (\mu_{1t}, \mu_{2t})$. The FMOLS estimator is expressed as:

$$\theta = \begin{bmatrix}\beta \\ \gamma_1\end{bmatrix} = (\sum_{t=2}^{T} Z_t Z_t')(\sum_{t=2}^{T} Z_t y_t^+ - T\begin{bmatrix}\lambda_{12}' \\ 0\end{bmatrix} \quad (20)$$

In equation 16, $Z_t = (X_t', D_t')'$. The FMOLS estimator shows a standard normal distribution asymptotically. The key point in FMOLS estimator is based on the estimation of (Ω and Λ) covariance matrices.

Since there is a cointegration relationship between the variables used in the study, the long-term cointegration coefficients were estimated by the FMOLS method. When the results of the FMOLS model in Table 7 are examined, it is seen that both SRED and LRED have a significant effect on GDP. However, it is seen that the effect of LRED on GDP is approximately 3.5 times greater than SRED, and a 10 per cent increase in LRED increases the GDP by approximately 5 per cent. Considering the public and private sector separation of external debt, the significant impact on GDP is seen in the public's short-term and long-term external debt. The magnitude of this effect is three times greater in favour of the long term. However, it is seen that private sector external debt has only a long-term effect on the gross domestic product. When the effects of external debt on consumption expenditures are examined, it is seen that both public and private sector debt are similar in terms of their effects on gross domestic product. However, the difference in short-term external debt of the private sector is striking regarding the effect of external debt on investment expenditures. SRP does not affect GDP and CONS, only INV. In addition, the investment-increasing effect of the public sector's external debt is approximately 2.5 times less than that of the private sector. And a 10 per cent increase in the SRP increases INV by 4 per cent. However, when it comes to long-term debt, public sector external debt seems to be more effective on INV, as is the case with GDP and CONS. This shows that the efficiency of the private sector in converting short-term external debt into investment is higher than that of the public sector. Still, external public sector debt in the long term leads to more investment.

Table 7: Results of FMOLS Model

Model		Cofficient	Standart Error	Test Statistic	R-Squared	Prob.
GDP = c + β_0.SRED + β_1.LRED	**SRED**	0.137	0.074	1.834		0.069*
	LRED	0.472	0.104	4.505	0.87	0.000***
	C	12.225	0.595	20.526		0.000***
GDP = c + β_0.SRG + β_1.SRP	**SRG**	0.217	0.033	6.512		0.000***
	SRP	0.070	0.067	1.037	0.82	0.302
	C	16.855	0.509	33.051		0.000***
GDP = c + β_0.LRG + β_1.LRP	**LRG**	0.639	0.082	7.733		0.000***
	LRP	0.133	0.038	3.519	0.90	0.000***
	C	10.719	0.596	17.983		0.000***
CONS = c + β_0.SRED + β_1.LRED	**SRED**	0.167	0.071	2.323		0.022**
	LRED	0.369	0.100	3.677	0.87	0.000***
	C	12.669	0.571	22.179		0.000***
CONS = c + β_0.SRG + β_1.SRP	**SRG**	0.205	0.028	7.171		0.000***
	SRP	0.055	0.057	0.953	0.84	0.342
	C	16.640	0.436	38.110		0.000***
CONS = c + β_0.LRG + β_1.LRP	**LRG**	0.603	0.083	7.242		0.000***
	LRP	0.109	0.038	2.851	0.90	0.005***
	C	10.919	0.601	18.159		0.000***
INV = c + β_0.SRED + β_1.LRED	**SRED**	0.365	0.092	3.966		0.000***
	LRED	0.508	0.128	3.944	0.91	0.000***
	C	7.841	0.732	10.705		0.000***
INV = c + β_0.SRG + β_1.SRP	**SRG**	0.175	0.051	3.427		0.000***
	SRP	0.409	0.103	3.942	0.85	0.000***
	C	12.134	0.782	15.515		0.000***
INV = c + β_0.LRG + β_1.LRP	**LRG**	0.724	0.108	6.697		0.000***
	LRP	0.315	0.049	6.345	0.90	0.000***
	C	6.254	0.780	8.011		0.000***

Conclusion and discussion

In the historical process, the concept of external debt, which dates back to very old times, has great importance in the economic literature due to the ability to sustain the economies of countries or other sub-reasons that have been the subject of the study. The phenomenon of globalization, which has been felt for the last few centuries, has increased its impact exponentially in the post-World War II period. For this reason, developed and developing countries resort to external borrowing to trade, make investments, realize defence and industrial expenditures, and ultimately grow economically. Since developed countries generally have surplus savings, they are mostly on the lender side of this process in external debt processes. Economic growth, which covers the other part of the study, is a phenomenon aimed at every country in the world but is also accepted as a macro indicator for countries. Economic growth refers to the quantitative change in the value of the gross domestic product, which is the financial equivalent of all goods and services produced within one year by the whole society, regardless of nationality, within a country's geographical boundaries, in a determined currency type.

In this study, the effect of external debt on economic growth is analysed with quarterly data between 1998 and 2021 provided by the Central Bank of the Republic of Turkey's Electronic Data Distribution System. The dependent variables used in the study are gross domestic product at fixed prices, consumption and investment, and sub-items of gross domestic product, respectively. The independent variables are short-term external debt, long-term external debt, short-term public sector external debt, short-term private sector external debt, long-term public sector external debt and long-term private sector external debt. In addition, the logarithm of the data of all variables was used. In this context, methods such as Augmented Dickey-Fuller, Phillips and Perron and Lee and Strazicich unit root tests, Johansen and Maki cointegration tests, Vector Error Correction Model causality analysis and Fully Modified Least Squares modelling were used.

In this study, it has been determined that external debt, which is handled separately in terms of both maturity and sector, has a positive effect on gross domestic product in all its independent variables, excluding short-term private sector external debt. Furthermore, it is seen that this situation is similar to the results of Gürdal and Yavuz (2015), among the studies that use structural break tests in their analysis. In addition, it is seen similar results with Umutlu et al. (2011), Çevik and Cural (2013), Korkmaz (2015), and Yıldız (2019). Finally, Hotunluoğlu and Yavuzer (2020) obtained from studies using tests that do not contain structural breaks.

Thus, according to the results of the analysis of the study, it was concluded that as external debt increases, economic growth also increases. However, no significant relationship was found between short-term private sector external debt and economic growth. This can be explained by the fact that the private sector mostly uses short-term debts as working capital, so it does not have an income-enhancing effect. When evaluated in terms of different maturities, it is seen that the effect of long-term external debt on growth is more than three times that of short-term debt. When it comes to sector separation, the effect of the long-term external debt of the public sector on growth is five times higher than the long-term external debt of the private sector. It was concluded that the same situation is valid for consumption, which is one of the sub-items of gross domestic product. When it comes to investments, it is seen that the effect of long-term external debt is more than short-term debt. The most important point to note here is that short-term private sector debt, which has an insignificant effect on gross domestic product and consumption, has a significant effect on investment and is about three times more than public sector short-term debt. The reason why the private sector's short-term debt does not have any effect on economic growth but increases investments more than the public sector can only be clarified by examining the sub-items of investment and in which areas the debt is used. However, this situation falls outside the scope of this study and may set an example for future studies.

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